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AGRICULTURAL NEWS LETTER

VOL. 5 - NO. 8 AUGUST, 1937

This publication gives information on new developments of interest to agriculture on laboratory and field investigations of the du Pont Company and its subsidiary companies.

In addition to reporting results of the investigations of the Company and its subsidiaries, published reports and direct contributions of investigators of agricultural experiment stations and other institutions are given dealing with the Company's products and other subjects of agricultural interest.

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METHYL CHLORIDE SHOWN TO BE A PRACTICAL REFRIGERANT WHEN MEASURED BY THE ACCEPTED THEORETICAL STANDARD

EDITOR'S NOTE:- Refrigeration in its relation to agricultural products in storage is of such present importance that there is recognized need for a better knowledge of the kinds of refrigerants available and the types of machines and systems for which the various refrigerants are adapted. Valuable information on the subject is set forth in a summary of a paper presented at the 24th Spring Meeting of the American Society of Refrigerating Engineers, French Lick, Indiana, June 10, 1937. The first part of this summary is given here.

By E. W. McGovern, Refrigerating Engineer,
The R. & H. Chemicals Department,
E. I. du Pont de Nemours & Company,
Wilmington, Delaware.

This paper discusses the properties desired in a theoretical ideal refrigerant and considers how various commonly used refrigerants measure up to them. The thesis is developed that a few practical refrigerants, among them Methyl Chloride, come closest to the theoretical ideal in different ranges of application. Particular attention is paid to the range of application of Methyl Chloride and, therefore, to the properties of Methyl Chloride.

In order to narrow the subject within reasonable limits, the term "refrigerant" is assumed to refer to substances producing refrigeration by change from the liquid to the gaseous state and the recovery of which in the liquid state for reuse is effected in a system embodying a mechanical compressor and a condenser. By doing this we exclude refrigerants for absorption systems, compressed gas systems working on the principle of cooling by gas expansion and "secondary" refrigerants such as ice and brines.

A "Practical Ideal" Refrigerant

A refrigerant really ideal in all respects is an impossibility. Undesirable features inevitably accompany some properties which are very desirable. A "practical ideal" refrigerant might be defined as one presenting the most favorable balance between all properties for the equipment and application intended - one in which too great a sacrifice must not be accepted in regard to one feature in order to obtain added advantage in another. For example, we cannot have the advantage of compactness of equipment which accompanies higher pressure refrigerants without bringing in the disadvantages of greater tendency toward leakage and requirement of heavier equipment for structural strength. A "practical ideal" refrigerant is one with the maximum of good features unaccompanied by any excessively bad features.

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The selection of such a refrigerant is further complicated by the question of type of machine and system in which it is to be used. Differences in machines and systems are partly to allow for differences in characteristics or departures from the ideal of the available refrigerants; they occur also because of type of application, initial cost, compactness, etc. We have reciprocating, rotary and centrifugal compressors, dry expansion and flooded systems with high side floats, low side floats, expansion valves and capillaries. No one system has proved ideal for all applications and each varies from the other in refrigerant requirements.

What qualities are possessed by the ideal refrigerant? Broadly speaking, a refrigerant should have such physical, chemical and physiological properties that a practically feasible machine can be built which will operate efficiently and safely to produce a desired effect. The ideal refrigerant would in general have the characteristics shown below.

Qualities of the Ideal Refrigerant

1. Stable. 2. Non-corrosive. 3. Low volume displacement. 4. Low condensing pressure. 5. Evaporating pressure above atmospheric. 6. Freezing point below refrigerating temperatures. 7. High critical temperature. 8. High latent heat of evaporation. 9. Low specific heat of liquid. 10. High specific heat of gas. 11. Low density, gas and liquid. 12. Low volume of liquid circulated. 13. Low viscosity, gas and liquid. 14. High heat conductivity and high film coefficients. 15. Low pressure differential between high and lows sides - low ratio of compression. 16. Liquid does not tend to superheat. 17. Self lubricating. 18. Non-reactive with lubricant. 19. Not excessively soluble in lubricant. 20. Dissolves water and ice. 21. No life hazard under any conditions - non-toxic. 22. No fire and explosion hazards. 23. Non-irritating. 24. Not harmful to foods, furs, flowers, textiles, etc. 25. Low leakage tendency. 26. Leaks easy to detect and locate. 27. Gives adequate warning of leakage. 28. Low cost - initial and maintenance.

The first twenty of these points are concerned mainly with behavior of refrigerant inside the system; they are technical properties necessary or desirable for efficient and trouble-free operation. The last eight are concerned mainly with behavior of refrigerant outside the machine and might be termed "popular" qualities, although ease of detection of leaks contributes toward reducing operating troubles.

Obviously some properties are more important than others. In choosing between various substances for a refrigerant we must remember that our primary purpose is to produce refrigeration and that, therefore, we must first eliminate those compounds with physical and chemical properties which make them impossible or too difficult to engineer. After such an elimination we can then make our final selection, drawing a proper balance between the various factors of an engineering nature as well as between engineering and hazard factors. Nature of application is of major importance in the selection.

(continued in next issue)

INCREASING THE SPEED OF READING GERMINATION TESTS BY A NEW METHOD AT THE NEW YORK EXPERIMENT STATION

EDITOR'S NOTE:- Dr. Crozier and Mr. Patrick explain how chemical treatment prior to laboratory tests isolates each seed from the disease germs of its neighbors. The method described permits faster and more certain reading than with untreated seeds. The article is reprinted from the July, 1937, issue of Farm Research, a quarterly bulletin of the New York Agricultural Experiment Station, Geneva, New York.

By Willard Crozier and Stewart Patrick,
N. Y. State Agricultural Experiment Station,
Geneva, New York.

The value of laboratory germination tests can be measured by their accuracy in predicting the field behavior of seed stocks. Perhaps the most accurate method of conducting tests would be to place each seed in a carefully cleaned glass dish on a pad of moistened cotton or paper. The annual testing of 15,000 to 20,000 samples, however, renders this procedure impossible. Small seeds are germinated on moistened blotting paper by hundreds and larger seeds such as beans, corn and peas are placed on large towels by hundreds and folded into loose rolls. Since the relative humidity always approximates 100 per cent the seeds rapidly develop their sprouts but, unfortunately disease organisms also develop profusely and often completely cover or rot the entire 100 seeds in a few days. Obviously some system is needed which permits a saving of space in the germinators but which also prevents contamination by disease germs. The use of chemicals, either as dips or as dusts, has been a practical and inexpensive solution of our problem.

Evaluation of Tests Speeded Up

The use of various chemicals has facilitated the appraisal of tests, particularly with the larger seeds. The chemicals are not intended to increase the average germination of all samples but rather to overcome the difficult reading of occasional samples. Growths of fungi may originate from a single seed and cover an entire roll of untreated seeds being tested in a few days. Peas may be so overrun with fungi and bacteria that adjacent rolls are invaded and ruined. This increases the time necessary in reading the untreated tests and decreases the accuracy of determining the value of the seeds. When the seeds are treated the increased cleanliness and freedom from troublesome fungous growths greatly accelerates the speed of determining the number of normal seedlings. And, moreover, when disease germs have rotted the seeds or destroyed the young spouts or untreated samples, similar treated ones have given a true and positive picture of the value of the seed stock.

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The ideal treatment would eliminate microorganisms causing the trouble or at least localize them at the point of origin. The percentage of germination from the treated should be comparable to that obtained in the field and the treatment should exert neither a stimulatory nor a toxic effect. The search for such a chemical has not ended. The present tendency is to compound materials by mixing fungicidal dusts commonly employed in the field, or by introducing inert ingredients to reduce the dosage of the active constituent adhering to the seeds.

Many Materials Tested

The chemicals tested include copper and mercury compounds, formalin and zinc oxide. With the exception of liquid formalin the materials were usually applied as dusts. The amount of some chemicals when used as recommended for field treating produced malformations, burning and necrotic lesions. Seeds treated so as to be protected in the soil and to produce strong seedlings often develop into abnormal sprouts in the closely confined laboratory rolls. In later experiments the abnormalities were largely prevented by diluting the chemicals with an inert dust.

Many of the mercury compounds have caused no seedling injury and invariably have given good control of the fungi. Ceresan, Merko, Sanoseed and New Improved Semesan, Jr. and others when used as manufactured have been satisfactory as dusts. New Improved Ceresan when diluted with five times its bulk of French talc, Wyojel, or button dust has surpassed all of the other materials with respect to normal seedling development, percentage of germination, freedom from microorganisms and cost of application but it releases a disagreeable gas. For this reason the correct dilution in aqueous suspension has been determined. At a concentration of 0.18 to 0.20 per cent the liquid adhering to pea seeds contains an effective dosage.

Just as seed treatments in the field are designed to establish a protective coat between the seedlings and the germs in the soil so are the laboratory treatments intended to protect each seedling and to allow it to develop normally during the laboratory test.

"Ceresan" and "Semesan" are trade names registered in the U. S. Patent Office by the Bayer-Semesan Company, Wilmington, Delaware.

RARE AND VANISHING SPECIES OF AMERICAN WILDLIFE STUDIED AND RESTORATION MEASURES PUT INTO EFFECT

EDITOR'S NOTE:- It is a self-evident fact that despite what federal, state and other agencies can do to conserve and restore valuable species of wildlife, the movement can not succeed to the desired extent without the practical cooperation of those concerned with or engaged in agricultural pursuits. There also is pressing need for aroused public sentiment in support of conservation and restoration measures. A picture of the existing situation is given in the article presented here.

By Ira N. Gabrielson, Chief,
United States Biological Survey,
Washington, D. C.

Much has been said recently of some of our rare birds and mammals and their chance of survival. It is a saddening thing to watch a species of bird or mammal pass forever out of the wildlife picture. Twice within my memory we have seen it happen in America. The last survivor of the once innumerable flocks of passenger pigeons ended its career in the Cincinnati Zoo in July, 1914, and with it vanished one of our most spectacular forms of wildlife. The heath hen is another vanished American. For some five years now unsuccessful search has been persistently made for the last survivor on Marthas Vineyard, and with this bird apparently gone, the hope of again seeing this species in the wild has also vanished. Not even Zoo specimens remain of this eastern form of the prairie chicken. Gone!

Call the roll of American wildlife, and no answer comes for passenger pigeon, heath hen, great auk, Labrador duck, Carolina paroquet, or Guadalupe caracara. No answer either from nearly a dozen subspecies of mammals--Maine giant mink, California grizzly bear, Tejon grizzly, Texas grizzly, Plains grizzly, Gull Island meadow mouse, Amargosa meadow mouse, Pacific white-tailed deer, Merriam elk, Badlands mountain sheep, and Texas mountain sheep. Gone. All gone.

Call the roll again and listen to the faint answers from more than two dozen forms that are even now threatened with extinction. Birds: whooping crane, trumpeter swan, great white heron, Eskimo curlew, Attwater prairie chicken, masked bobwhite (probably now extinct in United States), California vulture, red-bellied hawk, everglade kite, ivory-billed woodpecker, Ipswich sparrow, Bachman wardler, dusky kinglet, Laysan teal, Laysan finch, and Florida seaside sparrow. Mammals: Cuban almiqui, White Mountains (California) dwarf shrew (probably already exterminated), spotted bat, glacier bear, fish, black-footed ferret, wolverene, sea otter, desert fox, kit fox, plains or buffalo wolf, Guadalupe fur seal, monk seal, hooded seal, Pacific walrus, Atlantic walrus, eastern fox squirrel, peninsula fox squirrel, key deer, buttonwillow elk, Nelson mountain sheep, Sierra mountain sheep, Florida manatee, gray whale, Atlantic right whale, and Greenland right whale. If these species are to live on, something must be done now.

Continued on next page

Restoration Efforts Under Way

What are we doing for these species that are approaching the vanishing poi Not enough perhaps, but all that is possible under present conditions. Th Eskimo curlew is gone so far as we know and many of the other shore birds nearly joined them before complete protection gave them a chance. Some of species responded quickly but the long-billed curlew, Hudsonian godwit, up plover, and other of the more spectacular forms have responded more slowly The restoration of marshes, lakes, and grasslands now under way in the Pra States should ultimately have a beneficial effect on these birds if in the meantime they have not reached a point too low for recovery.

The purchase of Okefenokee Swamp when completed should insure the perpetua of such locally resident forms as the Florida sandhill crane, black bear, ivory-billed woodpecker (if any of the former small colony still remains), other species.

Red Rock Lakes, a beautiful waterfowl nesting area and a part of the great of bird refuges being developed, provides sanctuary for one of the few gro of trumpeter swans still remaining in the wild. During the summer of 1936 cygnets or young swans were raised on these lakes. The group in this refu and in Yellowstone Park, together with scattered colonies in British Colum are all that remain of this magnificent species that once bred as far sout Indiana, Iowa, Missouri, Nebraska, and Wyoming and north far into Canada.

Just recently the purchase of an area on the Texas coast as a water-fowl wintering ground has provided protection to the winter home of one of the l little bands of the great whooping crane, a magnificent American waterfowl that has all but joined the dodo and the great auk. A few pairs still bre in remote areas in Canada, but forty years ago it nested from Iowa northwa

Encouraging Results Seen

Every one of our great white waterfowl, including the white pelican, egret whistling swan and the two here discussed, have been greatly decreased in numbers, although the whistling swan and the two egrets are staging a good comeback under the protection given them in recent years. All of them need protection by law and by public sentiment if they are not to vanish from th earth. It seems that the impulse to kill something big and white is an ala irresistible one for many persons but one that must be curbed if we are to these vanishing species.

Some of the big-game ranges set aside, or in process of being set aside, in the West will give an opportunity to protect and increase such vanishing Americans as the Desert Mountain sheep, the sage hen, and the antelope, the last of which is already on the way toward again becoming a common and fasc nating inhabitant of the western plains.

Definite plans have been made for the creation of refuges to protect certa birds in areas where a few still exist. The ivory-billed woodpecker, as me tioned on the Okefenokee, is one of these. The limpkin, some of the kites,

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and some of the rarer herons are among others that will find protection and safety on new refuges that are either under development or scheduled for such work with the first available funds.

For some of the larger mammals, conditions are not so fortunate, although definite efforts are being made to work out satisfactory and workable plans to more adequately care for such species as moose, wolverene, grizzly bear, marten, and fisher, which are among those species most in need of special consideration if they are not to become extinct.

In this work a constantly developing public sentiment against the extermination of any of our interesting forms of wildlife is the most hopeful sign that the desired end may possibly be accomplished.

MORE EFFICIENT AND SAFER HYDROCYANIC ACID GAS FUMIGATION MADE POSSIBLE THROUGH USE OF A NEW TYPE CYANIDE GENERATOR

EDITOR'S NOTE: - tne cyanide generator described here, when properly used, contributes to safety, efficiency and economy of hydrocyanic acid gas fumigation. Full particulars of the construction and operation of this generator may be obtained on request. It is to be noted that fumigations should be carried out only by responsible professional fumigators or trained and experienced men.

Fumigation with HCN gas is recognized to be one of the best means of controlling insect and rodent pests in household and industrial structures. Its use has become so well established that fumigation with hydrocyanic acid gas is required or recommended by most public health officials, agricultural experiment stations, and other authorities.

This method of fumigation has proved its value in grain elevators, flour mills, tobacco houses, food factories and various other structures. There had been, however, a need for equipment which would permit more effective, economical, convenient and safer hydrocyanic acid gas fumigation. This need is met by a new cyanide generator. It is specially designed for production of gas from du Pont "Cyanegg"* (96 per cent sodium cyanide minimum).

The generator is sturdily constructed of acid-resistant metals and is simple in operation. Through its use local or complete fumigating can be done from outside the area to be fumigated or the premises. No other equipment is needed, not even pipes.

How Fumigation is Carried On

For fumigation, the structure is made ready in the usual way, i.e., windows, cracks, etc., are sealed and only a small opening or inlet left for the introduction of the fumigating gas. The generator is then charged and moved to a point outside the building, near the inlet. The conduit from the generator is fastened to the inlet of the building, a control valve on the generator is opened and the HCN gas then passes rapidly from the generator into the building.

When all the fumigating gas is discharged into the building, the control valve in the generator is closed and the building inlet sealed. The generator is then carried away, the residue cleaned out and the generator made ready for another fumigation. Thus the method provides a simple, economical fumigation, cuts down hazards and does away with the inconvenience of extensive clean-up.

Effective and Economical Application

The new cyanide generator supplies a hot HCN gas into the area to be fumigated through a rubber hose. Hot gases diffuse through any space more efficiently

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than cold gases, or liquids that must be vaporized. The generated HCN gas diffuses rapidly to all parts of the structure, in and about equipment, and at a fairly high temperature is most effective in the destruction of insects and other pests. No pumping or other mechanical means is required to bring the gas from the generator to the building inlet. The slight pressure developed within the generator is enough to push the gas on its way. The efficiency of the generator is rather high - 1 lb. of "Cyanegg" liberates approximately 8 ozs. of hydrocyanic acid gas which, at the fairly high temperature it is generated, is sufficient to fumigate 1,000 cu. ft. or more, depending upon the various conditions within the structure.

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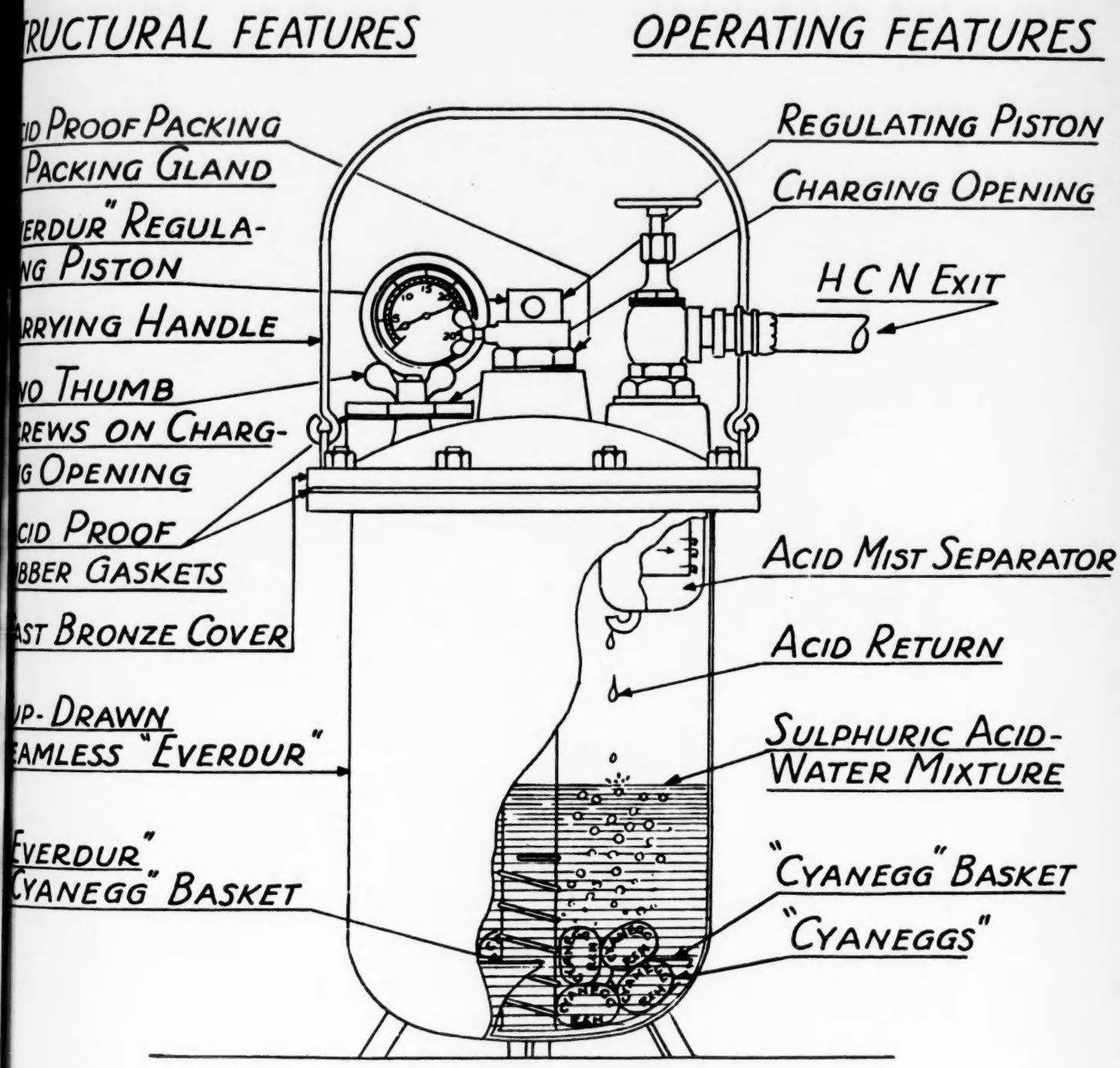
*"Cyanegg" is a trade name registered in the United States Patent Office by E. I. du Pont de Nemours & Company.



The new Cyanide GENERATOR showing details of construction and operating parts.

DRY SOIL BLASTING WITH DYNAMITE IS RECOMMENDED UNDER CONDITIONS WHERE ITS USE EFFECTS ECONOMY

EDITOR'S NOTE:- Mr. Livingston's article should stimulate thinking along the line of possible undiscovered uses of explosives in agricultural engineering work and for other purposes. There probably is a number of important uses to which dynamite could be put but for which this mobile source of power is not now employed. The editor would be glad to hear from readers who have developed new ways of using dynamite.

By L. F. Livingston, Manager,
Agricultural Extension Section,
E. I. du Pont de Nemours & Co.,
Wilmington, Delaware.

Most engineers recognize the value of Ditching Dynamite as an economical and quick means of excavating in wet swampy material. There also is general recognition of the fact that, as a rule, dry material can be excavated by machinery more economically than with explosives. However, a recent piece of work near Peoria, Illinois, demonstrated that under some conditions blasting offers definite advantages over mechanical methods in the removal of dry earth.

The case referred to was typical of instances where preference well could be given to blasting over the use of machinery. Here the moving of a machine from the nearest available point to the work would have cost more than the actual digging. This cost would have been considerably greater than the combined costs of labor and material for doing the job with explosives, and the time required would have been longer. Incidentally, time is frequently an important factor.

How the Work Was Done With Dynamite

This was a job of stream correction for the double purpose of remedying soil erosion and to protect a valuable field of alfalfa from flooding. Usually, this stream is dry, but due to a steep watershed it becomes a torrent for a short time after each heavy rainfall. Due to a bend and the velocity of the flow, serious erosion was resulting and the stream overflowed its banks.

Investigation showed the conditions could be corrected by a cut-off of the bend. This, it was found would require a new channel of sufficient depth and width for a distance of 200 feet.

One end of the channel required a cut of 12 feet depth and the other a six-foot cut. The three feet of top soil was loam, beneath which was very heavy gravel.

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The post-hole method, using bundles of sticks of dynamite, was used for loading the deepest section of the required channel. Holes were made 12 feet deep on six-foot centers. For the shallow section, column loading was used for holes six feet deep on three-foot centers.

As is necessary for all shooting in dry soil, one of the cartridges in each of the holes was primed with an electric blasting cap. Obviously, propagated shooting was impossible in the dry material. A 50-cap electric blasting machine was used. The job was shot in two sections of 100 feet each.

Federal Agency Active in Stream Correction

That the United States Department of Agriculture is fully awake to the importance of stream correction is evident from a statement issued in July, as follows: "Misbehaving streams cause an enormous amount of damage to fertile bottom-land farms, according to the Soil Conservation Service. Sometimes these streams wander out of their courses and cut new channels across fields and pastures; or they undercut the banks and eat back into valuable farmland or overtop the banks and leave heavy deposits of sand on unharvested crops.

"At sharp bends streams are particularly likely to kick over the traces. At the outside of the bend where the thrust of the flowing water is greatest they usually gnaw away at the bank. On the inside they often deposit soil matter washed down from farther up-stream. In this way, a gravel bar is sometimes built up on the inside of the bend which tends to "shove" the stream farther toward the outside bank and increase the cutting on that side.

As a part of its demonstration program of erosion control, the Soil Conservation Service is helping many farmers make these streams behave. On the outside bend of a stream where a considerable amount of cutting has occurred, Service engineers assist in building structures, such as jetties, which divert the flow away from the damaged area and give protective vegetation a chance to become established. Such trees as osier, willow, or dogwood are recommended for permanent protection."

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